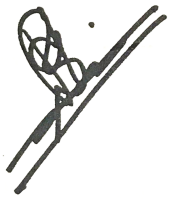


PHYSICS (GRADE-7)
Lesson - 50

ATOMIC STRUCTURE

Mrs. Ruksana & Mrs. Farhana

1. Explain the structure of an atom.

Atoms are made up of protons, neutrons and electrons. A proton has a positive charge, an electron has a negative charge and neutrons have no charge.

Protons and neutrons lie in the nucleus at the center of the atom, and the electrons orbit around the nucleus.

2. Differentiate among atomic number, mass number and neutron number.

Atomic number: The number of protons in the nucleus is called the atomic number of an atom. It is also the number of electrons in the atom. It is denoted by *Z*. The electrons determine the chemical properties of an atom. When the elements are arranged in the order of atomic number in the Periodic Table, they fall into chemical families.

Neutron number: The number of neutrons in the nucleus is called the neutron number of an atom. It is denoted by *N*.

Mass number: The sum of the number of protons and neutrons (nucleons) in the nucleus is called the mass number of an atom. It is denoted by *A*.

$$A = Z + N.$$

3. What is meant by isotopes?

Isotopes of an element have same atomic number but different mass numbers due to different neutron numbers.

For example,

Isotopes of hydrogen

${}_{1}^{1}\mathrm{H}$	${}_{1}^{2}\mathrm{H}$	${}_{1}^{3}\mathrm{H}$
$A = 1$	$A = 2$	$A = 3$
$Z = 1$	$Z = 1$	$Z = 1$
$N = 1-1 = 0$	$N = 2-1 = 1$	$N = 3-1 = 2$

Isotopes of chlorine

$^{35}_{17}Cl$ $^{37}_{17}Cl$

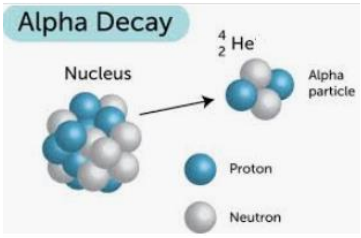
A = 35 *A* = 37

Z = 17 *Z = 17*

N = 35-17 = 18 *N = 37-17 = 20*

4. Explain Alpha (α) decay.

An Alpha (α) particle is a helium nucleus, having two protons and two neutrons, and when an atom decays by emission of an Alpha (α) particle, its nucleon number decreases by 4 and its proton number by 2.



For example, when radium (mass number 226, atomic number 88) decays by alpha emission, the loss of an alpha particle leaves the atom with two protons and two neutrons less than before. The mass number drops to 222 and atomic number to 86, which is Radon. Radium is the parent nucleus and Radon is the daughter nucleus. Here the alpha particles are emitted with 4.78 MeV of kinetic energy. The decay process can be written as a nuclear equation

$$^{226}_{88}Ra \rightarrow {}^{222}_{86}Rn + {}^{4}_{2}He + 4.78\ MeV$$

5. Write four properties of alpha particles.

i) Alpha particles are positively charged because they have two protons.

ii) They can be stopped by a thick sheet of paper, and have a range in air of only a few centimeters.

iii) Alpha particles have the greatest ionizing power.

iv) They produce fluorescence and effect photographic film.

6. Explain beta (β) decay.

In beta radiation, a neutron in the parent nucleus changes to a proton and electron. The electron escapes with high energy in the form of beta particles, and the proton remains inside the nucleus with the other protons.

$$ {}^{A}_{Z}X \quad \rightarrow \quad {}^{A}_{Z+1}Y \quad + \beta^{-} \quad + \quad \bar{\nu} $$

where $\bar{\nu}$ is called antineutrino, which has no charge and negligible mass, emitted in β-decay.

Example: i) Radioactive Carbon-14 decays by emitting beta particle and changes to Nitrogen-14.

$$ {}^{14}_{6}C \rightarrow {}^{14}_{7}N + {}^{0}_{-1}\beta $$

A = 14	*A* = 14
Z = 6	*Z = 7*
N = 14-6 = 8	*N = 14-7 = 7*

ii) Radioactive Caesium – 137 decays by emitting beta particle and changes into Barium – 137.

$$ {}^{137}_{55}Cs \Rightarrow {}^{137}_{56}Ba + {}^{0}_{-1}\beta $$

A = 137	*A* = 137
Z = 55	*Z = 56*
N = 137-55 = 82	*N = 137-56 = 81*

7. Write five properties of beta particles.

i) Beta particles are electrons with high energy.
ii) The speed of beta particle is 9/10 times the speed of light.
iii) They have greater penetrating power than alpha particles.
iv) They are stopped by a few millimeters of alluminium, and some have a range in air of several meters.
v) They have lower ionizing power than alpha particles.

8. Explain Gamma decay.

Gamma radiation is a simple loss of energy from a nucleus. An atomic nucleus releases gamma rays when it releases its extra energy. This emission does not change the mass number of atomic number. If a nucleus is in an excited state, it can become stable by emitting gamma radiation.

$$ {}^{A}_{Z}X \quad \rightarrow \quad {}^{A}_{Z}X + {}^{0}_{0}\gamma $$

9. Write five properties of gamma particles.

i) Gamma rays are energetic photons and have no charge
ii) They travel with the speed of light
iii) They have the least ionizing power
iv) They are the most penetrating, and are stopped only by many centimeters of lead.
v) They are no deflected by electric and magnetic field.